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NOTES ON THE BIOLOGY AND IMMATURE STAGES OF GERANOMYIA (Tipulidae, Diptera)

I. GERANOMYIA ROSTRATA (SAY)

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Geranomyia rostrata (Say) is one of the rather large number of crane-flies that has a notably wide distribution. Its range includes southern Canada, all of the eastern United States and extends southward thru the Greater Antilles; to the west it extends to the western extremity of the Northern Peninsula of Michigan, central Iowa and Louisiana. Over much of this range it is a common, often an abundant species.

The habitats in which the adults are to be found vary in many features but agree in being in the vicinity of flowing or standing water, or of seepage areas over rocks or earth. Stream ravines, moist shaded cliffs, banks of streams, low woods and several types of swamps (Arborvitae, black gum, and cypress) are typical habitats. Less frequently specimens may be swept from the sedges and grasses of open swales, wet meadows, and the borders of open marshes. In these latter situations the flies rest on the grass stems near the ground, shaded by the leaves of the rank grasses and sedges. The adults are often on the wing during the day in moist, shaded situations; however, night, dusk, and cloudy days are the times of greater activity, and then the flies range far from their normal day-time habitats. At times of continued cloudy wet weather they spread into such normally xerophytic situations as "High Pine" and dry oak woods and may be swept from the scant herbage of typical "High Pine" several hundred yards from the nearest normal habitat. In dry weather they are entirely absent from these situations even tho abundant in an adjoining brook-ravine or swamp.

Both sexes come freely to light and light-records include all hours between dusk and dawn, but extensive trap-lighting (one

of the lights ran regularly over a period of months in a cleared high-pine situation and 250 yards from the nearest *G. rostrata* habitat) indicates that altho the flies often range widely at night, their movements are dependent upon the relative humidity.

The feeding habits of this species, along with those of the other regional members of the genus, have been observed more fully than those of any other genus of crane-fly. Knab[1], Alexander[2], Alexander and McAtee[3], and Rogers[4] have listed a wide variety of plants from whose flowers nectar is taken. The varied species on which *G. rostrata* is known to feed makes it seem probable that nearly all nectar bearing flowers are available, particularly so, since the seasonal range of the fly extends from mid-spring to late fall in the northern part of its range and includes every month of the year in Florida.

The immature stages of *G. rostrata* are spent in wet mosses, among the thalli of liverworts and in mats of filamentous algae on wet rocks and shaded seepage areas. The general type of vegetational association or its stage in succession apparently makes little difference so long as even very small areas of these low plants exist. Larvae have been taken from an isolated, tho luxuriant, mat of wet moss on the root of a tree by a spring, where the moss clump was not over 4 or 5 cubic inches in extent. Clumps of wet moss or liverworts, whether they occur on wet rocks, on a stream bank, about a seepage area, on hummocks about the bases of the trees in a swamp, or on wet logs, are capable of providing a suitable habitat if they remain moist for periods of several weeks at a time. In north Florida in the winter and early spring such situations are frequent in all of the more moist terrestrial habitats; with the dry late-spring they become more restricted and are confined to a few permanently moist situations: the immediate borders of shaded springs and rills and the interior portions of the swamps. With the rainy season of June and July favorable situations are again

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[1]Knab, Frederick—The Feeding Habits of Geranomyia—Pro. Ent. Soc. Wash. XII—1910; pp. 61-65.

[2]Alexander, C. P.—The Crane-Flies of New York, Part I. Memoir 25, Cornell Univ. Agr. Exp. Sta., 1919; pp. 878 and 879 and ibid, Part II. Memoir 38, pp. 816 and 817.

[3]Alexander, C. P. and McAtee, W. L.—Diptera of the Superfamily Tipuloidea Found in the District of Columbia. No. 2344 from the Pro. U. S. N. M., 1920, p. 408.

[4]Rogers, J. S.—Some Notes on the Feeding Habits of Adult Crane-Flies—Fla. Ent. X, No. 1, April 1926, pp. 5-8.

extensive and this fluctuation in the extent of the larval habitat is reflected in the relative abundance of adults, as noted over several years collecting.

The larvae found among the liverworts occur between the moist layers of thalli, those in the moss lie in contact with the stems and feed upon the leaves, particularly the terminal leaves of the smaller stems. The translucent, greenish color of the larvae and their sluggish habit make their detection difficult. The older larvae are within moist, transparent, greenish tubes that have a gelatinous appearance, shrink greatly on drying, and are largely soluble in alcohol. The younger larvae are usually found free of a tube, tho this may be due to the disturbance made in searching the moss for larvae. Naked larvae placed in rearing jars with wet moss soon construct new tubes from which they crawl, when undisturbed, to feed. In some cases they return to the same tube, in others, new tubes are constructed. In the moss clumps taken in the field the tubes are deep within the moss and do not usually extend to the fresher leaves upon which the larvae have been observed to feed.

The pupae are found within the distal end of the larval tubes and are encased in an inner, thin, transparent, ellipsoidal capsule. Frequently naked pupae are found but this is presumably due to the vigorous washing to which the moss is subjected in searching for the immature stages. Such naked pupae placed in rearing jars with fresh, washed moss emerge into imagines with little mortality loss. These pupae, altho many of them are but newly pupated, do not construct either a tube or an inner capsule, but all pupae from larvae placed in the rearing jars have at least the inner capsule, and usually more or less of a tube.

Associated with the immature stages of *G. rostrata* in the moss and liverworts are an occasional salamander and a large population of various invertebrates. Among the latter are the larvae and pupae of the crane-flies: *Oropeza subalbipes, Tipula caloptera?, Tricyphona inconstans* (rare in this situation), and the supposed larvae of *Megistocera longipes.* Other *arthropods* include the immature stages of Chironimiidae, numerous small adult carabid beetles, small millipeds and juvenile, black, cursorial spiders.

Larvae and pupae are also found in great numbers in the thin mats of algae and diatomaceous sludge on the wet lime-stone rocks over which a small rill trickles and cascades. At the Devil's Mill Hopper, a deep limestone sink near Gainesville,

Fla., a number of spring rills trickle down the steep sides of the heavily wooded slopes. The largest of these streams runs over outcrops and blocks of fallen rim rock, whose faces are roughened and pitted with small erosion depressions. Wherever the water flows and trickles the rocks are covered with a thin layer of algae and, particularly in the pits and depressions, a sludge of fine organic sediment, rich in diatoms. Bordering these narrow rill courses the damp rocks are covered with thick mats of mosses and liverworts.

The larval tubes of *G. rostrata* are particularly common beneath the algae and sludge on the rock faces. Here the tubes are longer and more definite than in the moss, but are hidden beneath a coat of adhering sediment. The larvae creep about beneath the thin sheet of sludge and water and are frequently found, free of any tubes, in the pits and crevices of the rocks, but the older larvae are usually seen with at least the hinder part of the body in the tube and they quickly retreat wholly within the tube when disurbed. Both larvae and pupae are most numerous in the algal growth that is but partially submerged by the trickling water but all of the area is inhabited except the deepest and most rapid trickles. Before pupation the larval tube is extended to the partially submerged margins of the algal growth or into the more elevated points of alga of the slightly deeper water so that the movements of the pupa before emergence serve to thrust it above the surface of the water.

The larvae feed both upon the algae and upon the sludge of the rock faces. Long and often branching filaments of algae are injested entire and diatoms and unrecognizable debris form a considerable portion of the content of the alimentary canal. Occasionally what is recognized as a protozoan cyst is found in the digestive tract and the same cysts can be found in the sludge scraped from the rocks.

Larvae and pupae were collected from this area by brushing the wet rocks and collecting the dislodged specimens in a net. Most larvae and pupae so collected are dislodged from their tubes but can be reared with slight losses either on moist sludge and algae from the rocks, or on fresh moss.

The consocies of the algae and sludge covered rocks differ largely from those of the moss and liverwort mats. The larvae of *G. canadensis* occur in small numbers; more numerous are a small species of white amphipod, may-fly nymphs and net building caddis larvae. The younger larva of the same *Tipula cal-*

optera? occur here but the older larvae move into the adjoining moss mats to pupate, and the same or a very similar species of spider runs about over the wet rocks. The only vertebrates inhabiting this situation are numerous juveniles of the southern leopard frog, and an occasional salamander.

These wet rocks of the Devil's Mill Hopper and the partially submerged boulders of an old dam in the Santa Fe River are the only situations in Florida in which the immature stages of both *G. rostrata* and *G. canadensis* have been taken close together. In both cases *G. rostrata* was taken from both algal mats and in the moss of the slightly drier margins while *G. canadensis* could be found only in the thin, semi-submerged algae.

Adults of *G. rostrata* are numerous at all times about the wet rocks at the Mill Hopper, either resting from overhanging or vertical ledges or bobbing about on the wet rock surfaces. Oviposition is frequently observed, the eggs being placed beneath the edges of algal mats or in small pockets and crevices filled with silt and sludge. Usually the egg is deposited at the margin of the trickling water but frequently the fly stands with all her feet slightly submerged and places the egg well out in the sheet of water. The eggs are laid several inches apart, the oviposition being preceded by the characteristic bobbing motion. Frequently several spots are tried before the egg is finally laid, the ovipositor probing about in search of a suitable crevice. Ovipositing individuals are frequently stalked by one of the numerous spiders but in all the instances observed they made good their escape. However, spiders are occasionally seen with female flies in their jaws and probably some of these are taken while ovipositing.

DESCRIPTIONS OF THE IMMATURE STAGES

The only species of *Geranoymia* whose immature stages have been described hitherto is *G. canadensis* (Westw.). Its larvae and pupae were described and figured in detail by Alexander and Malloch in 1920.[5] Their material was taken in Illinois but I have larvae and pupae of the same species, taken in northern and central Florida, that agree entirely with their descriptions. Comparisons with *G. canadensis,* below, refer to their paper. Descriptions of the immature stages of other species of *Geranomyia* and a key to the known immature stages will be given in a subsequent paper.

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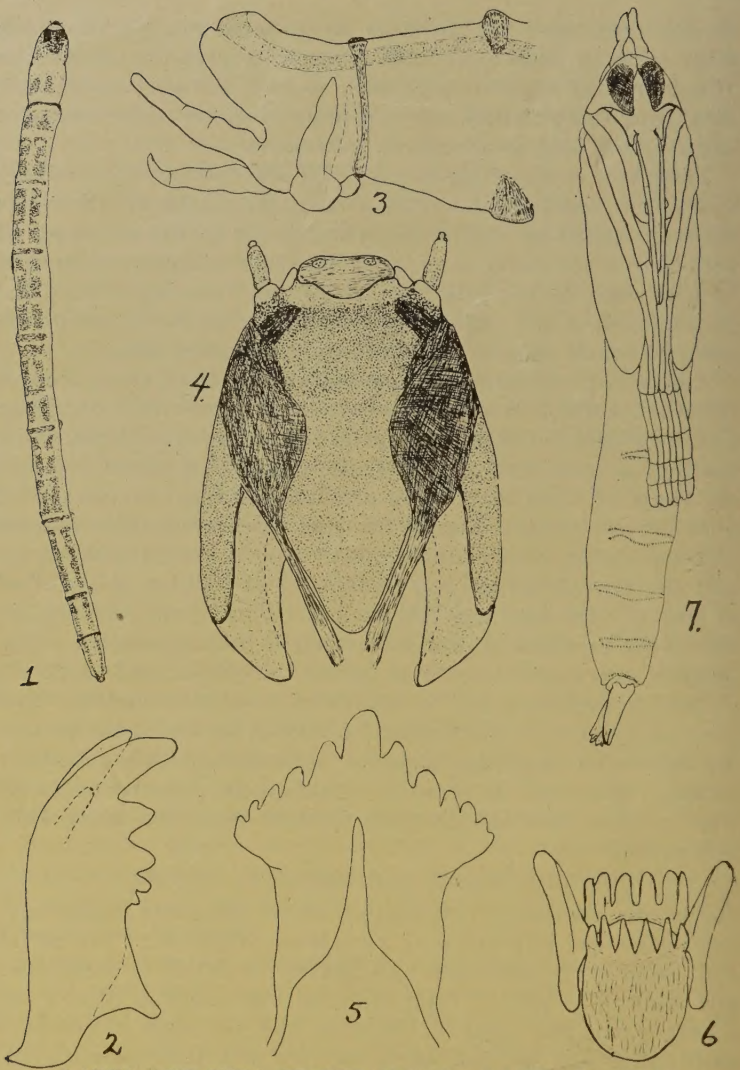
[5]Alexander, C. P. and Malloch, J. R.—Notes on the Life History of a Crane-Fly of the Genus Geranomyia Halliday. Trans. Ill. Acad. Sci. Vol. XIII, pp. 310-319.



LARVA AND PUPA OF GERANOMYIA ROSTRATA (SAY)

EXPLANATION OF FIGURES

1. Larva, dorsal view, x.7 Drawn from alcoholic specimen.
2. Mandible of larva.
3. Anal gills and posterior segments of larva, drawn from the side.
4. Head capsule of larva, dorsal view, x.60
5. Mentum of larva.
6. Hypopharynx of larva, from beneath.
7. Female pupa, ventral view, x.11.

THE LARVA

Length, 13-15 mm.; diameter at the second abdominal segment: dorso-ventral, 1 mm.; dextro-sinistral, 1.1 mm.; dorso-ventral diameter at the anterior abdominal creeping welt, 1.4 mm.

Form elongate, terete, tapering gently to the more slender posterior segments. The prominent creeping welts give the body a somewhat corrugated appearance. Color, in life, a semitransparent light green, the dorsum to either side of the central line with a grayish brown picture (fig. 1), and the creeping welts brown to dark brown. The tracheae and head capsule are clearly seen thru the integument. After death the body becomes an opaque yellowish white with the picture on the dorsum much more evident than in life.

Integument delicate, thin, transparent. Under a hand lens it is apparently glabrous but with higher magnification a covering of minute, erect hairs is visible and the apparent pigmentation of the dorsum is seen to be due to areas of dense, black, microscopic hairs. The creeping welts are well developed. Ventral welts occur on the cephalic margins of thoracic segments 2 and 3 and abdominal segments 1 to 8; dorsal welts occur on the cephalic margin of thoracic segment 3 and abdominal segments 2 to 8. The welts do not extend over the pleural region except on thoracic segment 3 and abdominal segment 8, where the dorsal and ventral welts meet to form complete circles, altho less developed in the pleural region. The ventral welts of abdominal segments 2 to 7 are broadly oval, bearing from 20 to 30 sub-parallel, transverse rows of minute, stiff hairs; the ventral welts of abdominal segments 1 and 8 are narrower, the stiff hairs longer and not so evidently in rows. The ventral thoracic welts are sub-triangular, densely covered with small stiff hairs. The dorsal welts are narrower than the ventral, not elevated, and composed of a few rows of somewhat longer hairs.

Respiratory disk small; it has the form of a cephalad directed notch in the end of the narrow caudal segment. The large oval stigmata are borne on the mesal faces of this notch which may be spread to an angle of about 140 degrees or closed until the faces are in contact. The lobes are rudimentary, the ventral pair represented by minutely protruded angles that are marked with a light brown pigmentation; the dorsal and dorso-lateral lobes are not discernable. The anal gills (fig. 3) delicate, transparent; the four lobes slender conical, and somewhat longer than in *G. canadensis*.

Head capsule (fig. 4) compact, the lateral plates extensive, the prefrons broadly triangular. Labrum broader than long, markedly chitinized anteriorly, brown, covered with short straight hairs; midway between the central line and either lateral margin of the labrum, at about midlength, there is a small circular membraneous area bearing three minute papillae. The antennae are borne upon broadly conical elevations; the basal joint cylindrical, moderately stout, unpigmented at its extreme ends; second joint sub-spherical, its diameter about a third of that of the first joint. Mandibles (fig. 2) broad and flat, spoon shaped, with seven, rather blunt, flat teeth. Dorsal tooth small, the apical tooth larger, the first ventral tooth largest of all; the four remaining ventral teeth are progressively smaller. The prosthecal appendage forms a rounded projection on the concave, mesal face of the mandible and bears a

tuft of stiff hairs. Maxillae with the cardines flat and chitinized; the lobes less flattened, membraneous, and bearing a covering of long dense hairs; a short, cylindrical, palpus-like organ near the base of the outer lobes. Mentum (fig. 5) large, the caudal cleft extending to the level of the bases of the anterior lateral teeth; central tooth prominent, bluntly rounded; five pairs of lateral teeth, progressively smaller toward the lateral margins, their apices not curved mesad. Hypopharynx (fig. 6) with the typical form of an oval chitinous collar formed of two plates. The anterior (dorsal) plate, a narrow band bearing six long, triangular teeth that are directed cephalad and are more nearly parallel than in *G. canadensis;* the posterior (ventral) plate small, disc-shaped, its anterior margin with six slender, smaller teeth, the surface of the plate with scattered coarse hairs. The juncture of the two plates, at the lateral margins of the hypopharynx, are attached to a pair of blunt chitinous rods that extend cephalo-laterad of the teeth of the anterior plate.

THE PUPA (Fig. 7)

Length, inclusive of the breathing horns, 8.5-9 mm.; length of breathing horns, 1 mm. Diameters at the mesothorax: dorso-ventral, 1.4 mm.; dextro-sinistral, 1.2 mm.

Form moderately slender, tapering gently to the slender cauda and more abruptly to the rounded cephalic apex; except for the slightly greater dorso-ventral diameter of the mesothorax, terete.

Color, in life: head, dorsum of thorax, wing and leg sheaths chestnut brown; the front, basis of the rostral sheath, and maxillary sheaths paler; eyes and pronotal breathing horns, dark brown. Abdomen a translucent greenish white marked with pale brown, transverse stripes on the dorsum and venter. After death the abdomen becomes opaque white, and the markings become more pronounced.

Head small, rounded conical; cephalic crest absent, tis usual position marked off from the antennal bases by almost obsolete lines. Bases of the antennal sheaths smooth, without angulations or spines; their apices ending a little past the bases of the wing sheaths. Eyes flattened, not projecting above the level of cheeks. Caudo lateral angles of the cheeks moderately projecting. The usual labral sheath is greatly prolonged to contain the elongate rostrum and mouth parts characteristic of *Geranomyia.* The proximal portion, between the eyes, has the sides parallel but is expanded a little below the eye margins; from either side of the expanded portion is borne a flattened cresentic maxillary sheath and just distad of their attachment the labral (or rostral) sheath is slightly constricted and immediately re-expands into the base of a long, blade-like plate that ends in an acute point slightly beyond the distal ends of the prothoracic tibia. The sheaths of the paraglossae arise from beneath the ventral horns of the maxillary sheaths and extend as a pair of lancet-shaped rods along the margins of the rostral sheath, and partly beneath it, to end slightly beyond the distal ends of the mesothoracic tibia.

Dorsum of the thorax smooth, unmarked; the cephalic margin of the mesonotum gibbous. The large, erect, pronotal breathing horns extend more than three fourths of their length cephalad of the head. They arise from the lateral margins of the pronotum and their bases are so arcu-

ated that the large, ear-like blades are almost in contact, their median faces parallel. The wing sheaths extend to the caudal margin of the second abdominal segment; the tarsal sheaths to about the middle of the fourth abdominal segment, where their apices form a level line.

The dorsum of the abdomen is marked with pale brown, transverse bands; on segments 2 and 3 these are broad and extend across the center of the segments; on segments 3 to 7 a pair of narrow bands across the anterior part of the segment enclose a double row of minute spicules, and a single narrow band extends across the posterior part of the segment. The stigmata of segment 8 are vestigial and barely discernable as a pair of faint brown dots. The venter of the abdomen is unmarked save for double bands of spicules across the anterior ends of segments 4 to 7. These bands of spicules are composed of several lines of close-set spicules and each double band encloses a pale, oval area that bears a few minute hairs.

The cauda lack entirely the curved chitinized hooks borne by *G. canadensis* and are less chitinized than in that species. The female cauda have the tergal sheaths but slightly longer than the sternal, the slightly divergent tips of the tergal sheaths notched on the lateral margins. The lobes of the male cauda are slightly flattened dorso-ventrally, are rounded laterally and the median faces are flat and in close contact.

DURATION OF THE IMMATURE STAGES

All the data on the length of the larval and pupal stages are based upon rearing done in northern Florida in an unheated room. The duration of both larval and pupal stages is affected by temperature. The normal span of the pupal stage in the spring is from five and a half to about six and a half days. Variations of about a day appear to be individual and not due to temperature or moisture. A generation carried from a fertilized female to the newly emerged adults, during March and April, required a little over seven weeks. The length of the egg stage was not determined but the time spent as larvae was probably close to six weeks. Since this was at the season when larvae are most numerous in the field and adults are emerging in numbers, it is probably close to the minimum period required. During January and February pupae required from two to four days more to complete this stage and do not emerge into adults on days when the temperature is below 45 or 50 F. In these same months larvae in a rearing jar failed to pupate within eight weeks.

A moderate degree of dessication in the rearing jars appears to hasten pupation on the part of larvae that are nearly grown, and frequently results in undersized adults. Similar small and palely colored adults are now and then taken in the field in the dry seasons. With younger larvae dessication results in either death or prolonged larval existence. As the habitat becomes

dry the larvae retreat into small crevices or deep into the silt about the roots and dead stems of the mosses and become very inactive. If the drouth is not so prolonged as to thoroly dessicate these crevices or areas of protected silt the larvae remain alive for some time and if placed in moist rearing jars with fresh moss soon resume feeding. Presumably such larvae will, under natural conditions, survive short dry periods and continue their development with the recurrence of sufficient rain to keep their moss clump wet for some weeks.

NEW THYSANOPTERA FROM FLORIDA

(Continued from Vol. X, No. 4, page 62)

Mouth cone long, reaching well past the posterior border of the prothorax.

Prothorax but little over half as long as the head and (including coxae) nearly three times as wide as long. Provided with five pairs of conspicuous bristles with pale dilated tips. One on each anterior angle, a pair along the anterior margin mediad to these, one near the middle of each lateral margin, one on each posterior angle and a pair mediad to these. Also one on each coxa.

Pterothorax about as wide as prothorax (exclusive of coxae), sides nearly straight and parallel. Three conspicuous knobbed bristles near the middle of the lateral margin, several pairs of smaller ones on the dorsal surface.

Legs rather slender, fore femora slightly enlarged, uniformly concolorous with the body except a black spot on each tarsus. Fore tarsi unarmed.

Abdomen heavy, widest at about segment 3, from which the sides are gently arched to the tube. A large knobbed bristle on the posterior angle of each segment (small on segments one and two) and a pair of equally large ones along the posterior border of each segment mediad to these. Abdomen marked by conspicuous diagonal lines which appear to be on the inside of the body wall.

Tube only two thirds as long as the head, width at base nearly two thirds the length, sides straight and converging sharply to the apex, three pairs of terminal bristles fully as long as the tube.

Measurements: Total body length 1.5 mm. Head, length 0.22 mm., breadth 0.17 mm.; prothorax, length 0.127 mm., breadth 0.35 mm.; pterothorax, breadth 0.30 mm.; abdomen, greatest width 0.39 mm.; tube, length 0.14 mm., width at base 0.09 mm., at apex 0.040.

Segment	1	2	3	4	5	6	7	8	
Length	39	47	62	59	56	53.5	53.5	54	
Width	47	33.5	34.5	34.5	31	27	25	18	microns

Male. Thorax and abdomen somewhat darker than in the female. Fore femora much enlarged. Fore tarsus with a large triangular tooth.

The

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MEETINGS OF THE SOCIETY

May 19, 1927.

The monthly meeting of The Florida Entomological Society was held in Science Hall at 4:00 P. M. Messrs. Montgomery, Merrill, Hubbell, Rogers, Gray, Berger, Tissot, and a number of visitors being present.

Mr. G. B. Merrill gave a graphic account of his studies made in Porto Rico, illustrated by a number of photographs showing points of interest in the Island along agricultural lines. Mr. G. F. Moznette who has long been a member of the Society, gave a detailed account of the Mosquito Campaign carried out at Miami. Many interesting points covered in his paper were discussed at length after its presentation.

June 9, 1927.

The regular monthly meeting of the Society was held in Science Hall at 4:00 P. M. Members—Berger, Brown, Calhoun, Goodwin, Grossman, Montgomery, Newell, Rogers, Stone and Tissot and visitors Camp, Kern, Knight, Loucks, Seal, Van Cleef and Walker were present.

Dr. Newell presented a paper on The National Plant Board and its activities, tracing the need and organization of such a board. This was the fundamental principles and subsequent activities of the Board.

THE THYSANOPTERON FAUNA OF THE INDIAN PIPE

J. R. Watson, Dept. of Entomology, Fla. Agric. Exp. Sta.

The Indian Pipe *(Monotropa uniflora* L.) is unusual in its ecological habitat and season of flowering. It grows on the forest floor in deep shade where large flowers which might attract thrips are scarce and it blooms late in the season.

For these reasons it occurred to the writer that an investigation of its thysanopterous visitors might be of interest. An opportunity was offered during the autumn of 1926 when the plant was unusually abundant in north central Florida. Collections were made from November 8 to December 19 from the, often quite diverse, situations in which the plant was found growing which included woods of pure pine and pure Live oak and various degrees of mixture of these and other species; and varying from a low hammock close to the swamp edge to rather high and dry sandy pine ridges. The plant was, however, never found in "flatwoods". In this work the writer had the enthusiastic cooperation of Mr. A. N. Tissot who did much of the collecting.

The thrips were invariably found inside the blossoms, never on the leaves and stems. Since the leaves are so thin that printing may be read thru them it is not strange that they were unattractive to thrips. Most of the insects were found to be feeding on the anthers of the stamens, but some were sucking the filaments or the pistil.

The infestation was not heavy, seldom over 10% of the flowers dissected contained thrips. Often there was but a single individual to a blossom but there was apt to be two or more in each blossom found infested. As the season advanced and the absolute number of blossoms decreased the percentage found infested rose.

Six species were taken—two of which are apparently undescribed and have not been taken from any other host. One of these which we are here describing under the name of *Thrips flavicauda*, was the most common species taken. In addition to the two new species the following were taken:

Haplothrips dozieri Wats. This was the second most abundant species taken. It is common to a large number of hosts. It is closely related to *H. gowdeyi* (Franklin), a West Indian species but may be distinguished by the shape of the head which is usually constricted posteriorly (in gowdeyi the head is usually broader posteriorly, at least not constricted) and by the number of interlocated bristles, 5 to 9 but usually 7 or 8 (5 or 6 in gowdeyi).

Frankliniella tritici bispinosa (Morgan).

Common but not nearly as abundant as in most blossoms.

Leptothrips mali (Fitch). A single specimen of this common predator was taken.

Trichothrips anomocerus Hood. A single specimen. This species is an addition to the Florida list.

Anaphothrips (Proscirtothrips) monotropae, n. sp.

Color by transmitted light—thorax an almost uniform pale yellowish brown (color of dull brass); abdomen, head, and antennal segments 1 and 5 lighter; eyes black. By reflected light almost white, but thorax and margins of abdomen heavily tinged with wax yellow (Ridgeway's Color Standards); eyes dark red; ocellar crescents carmine.

Head nearly 1.5 times broader than length of exposed portion. Head considerably retracted into prothorax. Occiput indistinctly reticulate, most plainly marked behind the eyes. Vertex rounded but little in front. Cheeks considerably arched, with a single small colorless bristle about the middle. A pair of short but thick and heavy brown bristles on the face (ventral surface) just below the insertion of the antennae. Eyes prominent, bulging, occupying more than half of the exposed part of the side of the head, pilose, lateral facets large, only about six outlined along the margin in dorsal view of head. Ocelli sub-approximate, situated rather far back on the head, the anterior about opposite the middle of the eyes, the posterior ones well separated from the margins of the eyes and about the size of the lateral facets of the eyes, the anterior much smaller; pale yellow, bordered by bright carmine crescents.

Antennae twice as long as the head. Segment 1 almost colorless; 2 concolorous with the head; 3, 4 and 5 grayish, progressively paler, 5 almost colorless; 6-9 darker, brownish gray; 2 and 6 with broad pedicels, 3-5 with narrower ones; 2 barrel-shaped, 3 oval, 4 and 5 obovate, 5 with almost straight but sharply converging sides in proximal .4, 6 and 7 together elliptical. Bristles and sense cones pale and inconspicuous. Simple sense cones on segments 3 and 5, and a bifurcate one on 4.

Mouth cone long, reaching nearly across the prosternum.

Prothorax subrectangular, a little wider and considerably longer than the head; at each posterior angle there is a thick heavy dark brown bristle, the only conspicuous ones on the prothorax. These bristles vary much in length, from 25 to 38 microns in different individuals. At each anterior angle are two short colorless bristles and about twenty pairs scattered over the dorsal surface, and 4 pairs along the posterior margin.

Mesothorax almost semicircular in outline, widest at posterior margin, anterior angles well rounded. Metathorax narrower, sides straight and nearly parallel. Legs slender and weak, concolorous with abdomen.

Wings—rather short, membrane grayish, 18 to 20 rather conspicuous brown bristles on the anterior vein, spaced more closely in proximal part. They are, roughly, in about eight groups of 4 (or 5), 4, 4 (more widely spaced), (1), 1, 2, 1, 1, (1) bristles each. The posterior vein bears from 11 to 13 bristles, irregularly placed, the first opposite the 6th or 7th on the anterior vein.

Abdomen cylindrical, of about uniform width to about segment 6, thence rounded to the tip. Last segment split open, extreme tip orange yellow. Rather weak spines on each posterior angle from the fourth segment on, and a similar appressed one about the middle of the lateral margin of each segment. Those on last two segments abruptly longer but only of moderate length.

Measurements: Total body length 0.9 mm.; (0.75 to 1.05 mm.). Head, length (exposed portion) 0.09 mm., width 0.14 mm.; prothorax, length 0.118 mm., width 0.16 mm.; mesothorax, greatest width 0.23 mm.; abdomen, greatest width 0.24 mm. Antennae, total length 0.205 mm. Segments: 22, 35, 40, 42, 36, 34, 10, 10, and 13 microns long.

Male. Similar to female in color but considerably smaller.

Measurements: Total body length 0.6 mm. Head, length (exposed portion) 0.06 mm.; width 0.12 mm.; prothorax, length 0.09 mm.; width 0.14 mm.; mesothorax, greatest width 0.18 mm.; abdomen, greatest width 0.15 mm. Antennae, total length 0.20 mm. Segments: 21, 32, 37, 35, 33, 27, 10, 8 and 10 microns.

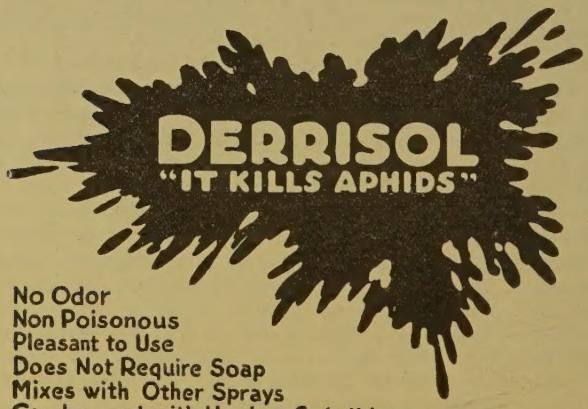
Described from ten females and four males.

Resembles *A. longipennis* Crawford in size and color, and in the head wider than long. But the head is even wider, not markedly rounded in front, the mouth cone longer, wings shorter with more numerous and conspicuous spines and the bristles on the posterior angles of the prothorax are shorter but heavier and brown.

To the unaided eye this insect resembles *Frankliniella tritici bispinosa* Morgan with which it is found, but can be told by its smaller size and lighter color.

(To be continued)

The New Spray for Aphis



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Non Poisonous
Pleasant to Use
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Mixes with Other Sprays
Can be used with Hard or Soft Water

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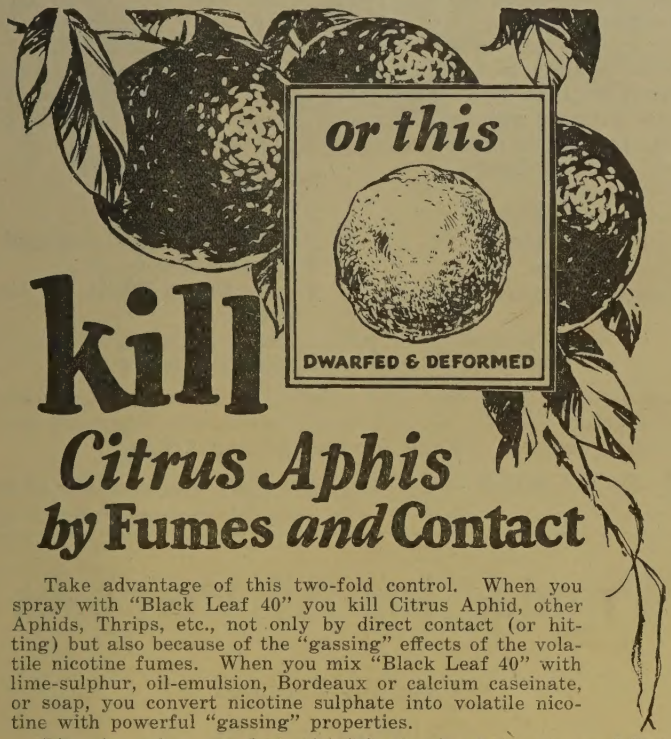

kill Citrus Aphis by Fumes and Contact

Take advantage of this two-fold control. When you spray with "Black Leaf 40" you kill Citrus Aphid, other Aphids, Thrips, etc., not only by direct contact (or hitting) but also because of the "gassing" effects of the volatile nicotine fumes. When you mix "Black Leaf 40" with lime-sulphur, oil-emulsion, Bordeaux or calcium caseinate, or soap, you convert nicotine sulphate into volatile nicotine with powerful "gassing" properties.

Likewise, when you dust with Nicotine Dust, insects are killed by actual contact of the dust with their bodies and also by the powerful nicotine gas.

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Bluestone	Copperas
Bordeaux Mixture	Fish Oil Soap
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